Hall Ticket Number:

Code No. : 21502

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

M.E. (ECE: CBCS) I-Semester Main Examinations, January-2018

(Communication Engineering & Signal Processing)

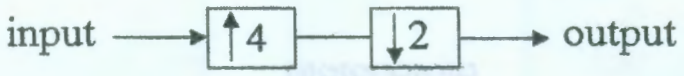
Advanced Digital Signal Processing

Time: **3** hours Max. Marks: **60**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

1. Calculate the Nyquist rate of the signal $x(t) = Cos(150\,\pi t)\ Sin\ (100\,\pi t)$
2. What is an anti-aliasing filter?
3. List the advantages and disadvantages of bilinear transformation.
4. Mention any two procedures for digitizing the transfer function of an analog filter.
5. Discuss the applications of multi-rate signal processing.
6. If $x(n)=\{2,\ 1,\ 4,\ -2\}$ is input to the following rate conversion system, find output of the system.



7. Consider a two channel QMF bank with the following analysis and synthesis filters $H_0(z) = 2-z^{-1}$, $H_1(z) = 2 + 3z^{-1}$, $G_0(z) = -1 + 1.5z^{-1}$, $G_1(z) = 1 + 0.5z^{-1}$. Is it a perfect reconstruction system?
8. What is the condition required for a perfect reconstruction in a M channel filter bank.
9. Compare STFT and wavelet transform.
10. Mention the difference between Daubechies orthogonal filters and Daubechies biorthogonal filters.

Part-B (5 × 8 = 40 Marks)

11. a) Explain Goertzel algorithm to compute DFT. [4]

    b) Find the response of the following difference equation: [4]

    $y(n) + y(n-1) = x(n)\ Where\ x(n) = u(n)$

12. a) Obtain the direct Form I structures for the system [4]

    $y(n) - 5/6\,y(n-1) + 1/6\,y(n-2) = x(n) + 2x(n-1)$

    b) Compare IIR and FIR filters. [4]

13. a) Show that a cascade of a factor L up sampler and a factor of M down sampler are interchangeable with no change in the input and output relation if and only if L and M are relatively prime numbers. [2]

    b) The sampling frequency 3072 KHz of a signal is to be decimated by a factor of 64 to bring it down to 48 KHz for which the pass band and stop band ripples for the decimator are 0.001 and 0.0001, respectively. The pass band ranges from 0-20 KHz. Design a two stage decimator with decimation factors 16 and 4 for the first and second stages, respectively. [6]

Contd... 2

Code No. : 21502

14. a) Derive the expression for perfect reconstruction in a two channel QMF filter bank. [4]

    b) Consider a two channel QMF bank with the analysis and synthesis filters given by $H_0(z) = 2 + 6z^{-1} + z^{-2} + 5z^{-3} + z^{-5}$, $H_1(z) = H_0(-z)$, $G_0(z) = H_0(z)$, $G_1(z) = -H_1(z)$ Check whether it is alias free or not. [4]

15. a) What do you mean by multi-resolution analysis and explain. [4]

    b) Write the equations for the wavelets orthogonality and regularity conditions for N = 2. [4]

16. a) Define Quantization effect. [4]

    b) Show that the FIR filters have linear phase response. [4]

17. Answer any ***two*** of the following:

    a) Write notes on Oversampling ADC analysis. [4]

    b) Obtain the necessary conditions for linear phase for FIR QMF bank to be perfectly reconstructed. [4]

    c) Classify the Wavelet filters. [4]